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(54) Title of the Invention Touch operation Type Input Device and its Electronic Part

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(54) [Title of the Invention] Touch operation Type Input Device and its Electronic Part

(57) [Abstract]
[Topic] A touch operation type input device that can detect the position, displacement value and pressure of a contact point that moves and shifts along a 1-dimensional, 2-dimensional or 3-dimensional trajectory.
[Solution] This is a touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means that turns the point of contact on and off by movement along a trajectory different to the direction of the finger movement or by applying pressure using the touch position detection sensor as well as integrated detection of the position information from the point of contact along a trajectory according to the touch position detection means and the on/off information from the point of contact according to the switching means.

[Claims]
[Claim 1] A touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means that turns the point of contact on and off by movement along a trajectory different to the direction of the finger movement or by applying pressure using the touch position detection sensor; that can provide integrated detection of the state of a touch position along a trajectory and the state of a contact according to the switching means.
[Claim 2] A touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means that turns the point of contact on and off by movement intersecting the trajectory or by applying pressure using the touch position detection sensor; that can provide integrated detection of the position information from the point of contact along a trajectory according to the touch position detection means and the on/off information from the point of contact according to the switching means.
[Claim 3] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors that have contact points along a trajectory where the electrostatic capacity changes between the time of contact and the time of non-contact are detected as signal changes using the electrostatic induction type detection means.
[Claim 4] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors containing a moveable electrode type detection means that uses primary electrodes continuously arranged along a trajectory and secondary electrodes arranged intermittently to detect the pressure of a finger since some are moveable electrodes and others are stationery electrodes.
[Claim 5] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors containing an optical detection means with luminous elements and light receiving elements arranged continuously in groups along both sides or one side of a trajectory.
[Claim 6] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors containing a resistant film detection means that can detect the displacement, amount of movement and pressure by detecting the pressure of the contact position

generated by the electrical distribution between the electrode drive pressure and the contact pressure.

[Claim 7] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors that detect the resistance such as a finger reaching between metal contact points and that utilizes a direct current resistance detection method for the fluctuations between the high and low levels of output.

[Claim 8] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors that utilize an electromagnetic induction method with magnetic film.

[Claim 9] A touch operation type input device as claimed in Claim 1 and 2 that is comprised of a touch position detection means with touch position detection sensors that utilize an ultrasonic method using ultrasonic oscillation.

[Claim 10] A touch operation type input device as claimed in any of Claims 1-9 comprised of a switching means that turns the contact points and the protrusions on and off when the protrusions located on either one or both sides of the touch position detectors on the touch position detection means are pressed down.

[Claim 11] A touch operation type input device as claimed in any of Claims 1-10 comprised of an arrangement of luminophors located below a touch position detector on the touch position detection means or the surrounding area, or on something that allows light to penetrate the touch position detector that flashes according to the touch detection status.

[Claim 12] A touch operation type input device as claimed in any of Claims 1-11 comprised of a switching means that turns the contact points on and off without touching the touch position detection means, and connects to the touch position detection means when the contact point and the touch position detection means are pressed down at the same time.

[Claim 13] A touch operation type input device as claimed in any of Claims 1-12 comprised of a switching means that turns the contact points on and off without touching the touch position detection means, and connects to the touch position detection means when the contact point is pressed down.

[Claim 14] A touch operation type input device as claimed in any of Claims 1-13 comprised of a switching means comprised of a swinging column structure where one end can swing and the other end is subject to pressure that turns the contact points on and off.

[Claim 15] A touch operation type input device as claimed in any of Claims 1-14 where the touch position detection sensors are arranged along a multiple touch detection trajectory that is either the same or different from the displacement unit.

[Claim 16] A touch operation type input device as claimed in any of Claims 1-15 where the touch position detection sensors are either uniformly distributed in a wide band or non-uniformly distributed with varying densities.
[Claim 17] A touch operation type input device as claimed in any of Claims 1-16 where the touch position detection sensors detect the contact position with at least one, two or three or more adjacent sensors.
[Claim 18] A touch operation type input device as claimed in any of Claims 1-17 where the switching means has multiple push switches.
[Claim 19] A touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc;

a substrate with contact points containing a means to transmit electrical signals or voltage between touch position input contact points that has a touch position input unit that can move horizontally within a given range; a spring that horizontally presses against the touch position input unit; and a push switch on the substrate with contact points that act to press the touch position input unit against the force of the spring.

[Claim 20] A touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; a substrate for the touch position input unit with fixed contact points and a push switch on the top that is operated from the top; a holder for the touch position input unit that has a support attached to the substrate to support swinging and that has contact points on the bottom corresponding to the fixed contact points; protrusions around the area where the tip drives the push switch by swinging the part, and a push switch that can be pressed when sufficient pressure is applied to the parts of the touch position detector.

[Claim 21] A touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; a substrate for the touch position input unit with fixed contact points and a push switch on the top that is operated from the top; a support on both sides or the lower center of the touch position detector can go up and down into an axle opening for a guide on the substrate; an elastic part between the touch position input unit and the substrate that provides flexible resistance towards the stop on the top of the substrate; and a push switch that can be pressed when sufficient pressure is applied to the parts of the touch position detector against the resistance of the elastic part.

[Claim 22] A touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; touch position input units that are inserted into the cavities, openings or penetration holes on the touch position input unit as a method to connect the support parts; a push switch that can be pressed when sufficient pressure is applied to the spring that horizontally presses against the touch position input unit.

[Claim 23] A touch operation type electronic part with a push switch as claimed in any of the Claims 19-22 that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; and a means to press the push switch using compression or expansion of a flexible part by pressing against the touch position input unit using an elastic part for the force against the touch position input unit in a specific direction.
[Claim 24] A touch operation type electronic part with a push switch as claimed in any of the Claims 19-23 that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; and a means to press the push switch using compression or expansion of a flexible part different that the touch position input unit.
[Claim 25] A touch operation type electronic part with a push switch as claimed in any of the Claims 19-24 where the means to press the push switch is a single mechanism, that is arranged apart from the position where the touch position input unit is located or adjacent to the touch position input unit.
[Claim 26] A touch operation type electronic part with a push switch as claimed in any of the Claims 19-25 where there are irregularities on the fingertip contact surface of the touch position detection means.
[Claim 27] A touch operation type electronic part with a push switch comprised of a means to detect a single touch with touch detection sensors installed on the tops of keys.
[Claim 28] A touch operation type electronic part with a push switch comprised of a means to detect several contacts with multiple touch detection sensors installed on the top of a key.
[Claim 29] A touch operation type electronic part with a push switch with a touch panel installed on the top of a key.
[Claim 30] A touch operation type electronic part with a push switch comprised of a means to detect contact with a touch panel installed on the top of a key.
[Claim 31] A touch operation type electronic part with a push switch as claimed in any of the Claims 1-30 where there are touch detectors on the tops of keys installed on the switching means apart from the sensor contact point when pushed.
[Claim 32] A touch operation type input device as claimed in any of the Claims 1-31 where the switching means is conducted by a momentary method, an alternating method or a locking method.
[Detailed Explanation of the Invention]
[0001]

[Industrial Field of Application] This invention is used as a remote control for all types of electronic mechanisms or a portable compact electronic mechanism, specifically a touch operation type input device to input displacement information of fingertip movement detected by contact as well as

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a touch operation type electronic unit that drives the touch operation switch, touch detection and push operation.
[0002]
[Existing Technology] Currently, there are slide switches with moveable knobs that switch the contact points along a single dimension. There are also rotating slide switches that switch the contact points at intervals on a two-dimensional circle. These have moveable knobs that are not finger or hand contact points or displacement value detectors. Also, there are contact sensors that turn the contact point on/off when contact is detected. These are continuously arranged on a specific trajectory and do not have a shield that prevents interruption of smooth finger contact or an integrated sheet covering. There is no algorithm or logic that specifically considers fingertip operation. For contact other than via moveable knobs using fingertips or pen tips, there are touch panels to detect the position on a 2-dimensional plane on the X/Y axis, displacement values and pressure. Electronic parts that detect the position of a contact point with the tip of a finger to detect the position, displacement values and pressure on a predetermined 1-dimensional, 2-dimensional or 3-dimensional trajectory as well as calculate their displacement and amount of movement, or output the displacement or amount of movement calculated do not exist at the present time. At the present time, mechanisms using these types of electronic parts contain electronic parts such as touch panels for touch operation and separate parts such as switches for push operation. Thus, operation consists of two separate parts. The structure and a representative process for the touch panel is given as follows.
[0003] (1) Electrostatic induction: This is a 2-dimensional touch position detection method that detects electrostatic capacity conversions as signal conversions such as frequency and phase conversions when the panel surface is touched and not touched. Examples include "PCT International Kokai W092/08947 Report", "PCT International Kokai W092/14604 Report", "IEEE Computer Society Press Report 'A Capacitance-based Proximity Sensor for Wholearm Obstacle Avoidance', J.L.Noval, J.T.Feddema, Reprinted form Proceedings of the 1992 IEEE International Conference on Robotics and Automation, Nice, France, May 12-14, 1994", and "Kokai H8-77894 Report".
[0004] (2) Resistant Film: An electrical potential distribution was generated on two conductive sheets using an X-axis and Y-axis. The change in voltage when the panel surface on the conductive sheet is touch is detected by the touch position detection method on a 2-dimensional surface. This can also be an analog or digital method. Examples include those in "Kokai S47-36923 Report", "Kokai S61-208533

Report", "Kokai H8-54976 Report", "Kokai H4-4420 Report", "Kokai H4-15813 Report".

[0005] (3) Moveable Electrode: Multiple electrodes were arranged on one side of a gap such as one parallel to the Y-axis using position detection on the X-axis of a 2-dimensional surface. Multiple electrodes were arranged perpendicular to that on the Y-axis. One of these were designated moveable electrodes so there was a touch position detection method on a 2-dimensional surface by detecting contact with several electrodes from pressure along the Z-axis. An example is in the "Kokai H4-15723 Report".

[0006] (4) Optical Detection: Infrared LED or phototransistors were arranged on both sides of a gap parallel to the Y-axis using touch detection on the X-axis of a 2-dimensonal surface. Infrared LED or phototransistors were arranged on both sides of a gap perpendicular to this using touch detection on the Y-axis. By pressing from the Z-axis direction, the touch position detection method on a 2-dimensional surface detects the position and the range where the optical beam was interrupted. Examples are in the "Kokai H2-53129 Report" and the "Kokai H5-35403 Report".

[0007]

[Problems this Invention is to Solve] Nothing has been invented that can detect the position, displacement value and pressure from a fingertip or a pen for the movement or displacement of a contact point along a specific trajectory such as a line segment, curve, arc, sphere, ball shape or an intersecting cross shape. All of the touch detection sensors used in touch panels, touch pads, tablets and touch sensors reported in the official Kokai gazettes to date are arranged in continuous bands along a specific 1-dimensional, 2-dimensional or 3-dimensional trajectory. Thus detection is possible at a distance from the endpoint when there is a line segment on a straight line extending from a curved line on a specific trajectory. Detection of the distance a finger is moved and the time of movement is also necessary. For such use, the touch panel or slide switch as well as the structure along a trajectory would be different than that of existing products. A 2-dimensional touch detection structure is needed, as well as a continuous arrangement along a trajectory. Thus, it is possible to incorporate a structure and some of the benefits of using the laws of nature for all of the touch panels, touch pads, tablets and touch sensors developed at the present time.

[0008] Recently, there have been many contact type detection means and sensor shapes for position detection along an X-Y axis. However, there has been nothing that can perform touch detection along a specific trajectory for position detection along two axes. It has been suggested that touch detection along a specific line, plane curve or arc in a continuous string would be very appropriate. Currently, there are technical preconceptions that a moveable slide

switch is used for detection of contact points along a continuous string, due to the economics of using slide switches.

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To date, it has been difficult to make portable electronic mechanisms compact and because of moving parts, the maintenance has been poor. At the present time, there has been a rotating operation type electronic unit with a push switch reported in Kokai H8-203387 to conduct selection and decisions of input items on portable electronic mechanisms with many multi-function input items but there needs to be more depth to the moving parts. Thus, there remains a demand for analog input without pressing a push switch that has moving parts.
[0009] In Kokai H3-192418, there is an input device that applies essentially the same pressure to the position setting means and provides a switch regardless of the position setting means with a connection mechanism composed of at least two plates that are hinged together. This device is comprised of a position setting means to determine the indicator position relative to specific coordinates and a pressure sensitive switch installed below this position setting means. When a sufficient amount of pressure is applied to the position setting means, the switch is operated to transmit the pressure from the switch to the connection mechanism. However, this has a position setting means to determine the indicator position relative to specific coordinates. As reported, the position setting means involves a 2-dimensional XY plane with at least two plates that are hinged together so that the position setting means can be used with coordinates that are spread apart. The position setting means is not something that can perform detection at a distance from a point on a specific string shape or line, plane curve or arc. Finally, the hinged shape cannot capture one point of pressure. Therefore, an input device is needed for movement or continuous touch switch contact along a specific arc trajectory.
[0010] There are existing finger contact type position setting means that can easily conduct input via fingertips or wrist motion that are large. However, there is nothing that can conduct input using only one finger with a rotating operation type electronic unit containing a push switch inside a portable electronic mechanism. This compact input device should integrate a simple position detector with structural parts that have sufficient strength and a press switch. Also, the remote control and portable electronic mechanism should be compact and lightweight for ease of use, and depending on the requirements, should have an operation switch with limited movement and a small number of parts. At the present time, the electronic parts such as touch panels for touch operation and switches for push operation are all separate parts so a compact device is not possible and it is difficult to operate two separate parts.
[0011] In view of these problems, this invention has the objective of providing a touch operation type input device that can detect the position, displacement value and pressure of a contact point that

moves and shifts along a 1-dimensional, 2-dimensional or 3-dimensional trajectory. Also, to solve the existing problems, the objective is to provide a touch operation type electronic unit with a push switch that can perform multiple operations with one unit so there can be an electronic mechanism structure that has good operability and is lightweight because of fewer parts.

[0012]

[Means of Solving These Problems] This invention solves the problems listed above with a touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means that turns the point of contact on and off by movement along a trajectory different to the direction of the finger movement or by applying pressure using the touch position detection sensor; that can provide integrated detection of the state of a touch position along a trajectory and the state of a contact according to the switching means. This invention solves the problems listed above with a touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means that turns the point of contact on and off by movement intersecting the trajectory or by applying pressure using the touch position detection sensor; that can provide integrated detection of the position information from the point of contact along a trajectory according to the touch position detection means and the on/off information from the point of contact according to the switching means. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors that have contact points along a trajectory where the electrostatic capacity changes between the time of contact and time of non-contact are detected as signal changes using the electrostatic induction type detection means. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors containing a moveable electrode type detection means that uses primary electrodes continuously arranged along a trajectory and secondary electrodes arranged intermittently to detect the pressure of a finger since some are moveable electrodes and others are stationery electrodes. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors containing an optical detection means with luminous elements and light receiving elements arranged continuously in groups along both sides or one side of a trajectory. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position

detection sensors containing a resistant film detection means that can detect the displacement, amount of movement and pressure by detecting the pressure of the contact position generated by the electrical distribution between the electrode drive pressure and the contact pressure.

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This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors that detect the resistance such as a finger extending between metal contact points and that utilizes a direct current resistance detection method for the fluctuations between the high and low levels of output. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors that utilize an electromagnetic induction method using magnetic film. This invention solves the problems listed above with a touch operation type input device that is comprised of a touch position detection means with touch position detection sensors that utilize an ultrasonic method using ultrasonic oscillation. This invention solves the problems listed above with a touch operation type input device comprised of a switching means that turns the contact points and the protrusions on and off when the protrusions located on either one or both sides of the touch position detectors on the touch position detection means are pressed down. This invention solves the problems listed above with a touch operation type input device comprised of an arrangement of luminophors located below a touch position detector on the touch position detection means or the surrounding area, or on something that allows light to penetrate the touch position detector that flash according to the touch detection status. This invention solves the problems listed above with a touch operation type input device comprised of a switching means that turns the contact points on and off without touching the touch position detection means, and connects to the touch position detection means when the contact point and the touch position detection means are pressed down at the same time. This invention solves the problems listed above with a touch operation type input device comprised of a switching means that turns the contact points on and off without touching the touch position detection means, and connects to the touch position detection means when the contact point is pressed down. This invention solves the problems listed above with a touch operation type input device comprised of a switching means comprised of a swinging column structure where one end can swing and the other end is subject to pressure that turns the contact points on and off. This invention solves the problems listed above with a touch operation type input device where the touch position detection sensors are arranged along a multiple touch detection trajectory that is either the same or different from the displacement unit. This invention solves the problems listed above with a touch operation type input device where the touch position detection sensors are either uniformly distributed in a wide band or non-uniformly distributed with varying densities.

This invention solves the problems listed above with a touch operation type input device where the touch position detection sensors detect the contact position with at least one, two or three or more adjacent sensors. This invention solves the problems listed above with a touch operation type input device where the switching means has multiple push switches. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; a substrate with contact points containing a means to transmit electrical signals or voltage between touch position input contact points that has a touch position input unit that can move horizontally within a given range; a spring that horizontally presses against the touch position input unit; and a push switch on the substrate with contact points that act to press the touch position input unit against the force of the spring. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that correspond to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; a substrate for the touch position input unit with fixed contact points and a push switch on the top that is operated from the top; a holder for the touch position input unit that has a support attached to the substrate to support swinging and that has contact points on the bottom corresponding to the fixed contact points; protrusions around the area where the tip drives the push switch by swinging the part, and a push switch that can be pressed when sufficient pressure is applied to the parts of the touch position detector. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that corresponds to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; a substrate for the touch position input unit with fixed contact points and a push switch on the top that is operated from the top; a support on both sides or the lower center of the touch position input unit can go up and down into an axle opening for a guide on the substrate; an elastic part between the touch position input unit and the substrate that provides flexible resistance towards the stop on the top of the substrate; and a push switch that can be pressed when sufficient pressure is applied to the parts of the touch position detector against the resistance of the elastic part. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised

of a touch position input unit that generates electrical signals or voltage that correspond to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; touch position input units that are inserted into the cavities, openings or penetration holes on the touch position input unit as a method to connect the support parts; a push switch that can be pressed when sufficient pressure is applied to the spring that horizontally presses against the touch position input unit. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that correspond to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; and a means to press the push switch using compression or expansion of a flexible part by pressing against the touch position input unit using an elastic part for the force against the touch position input unit in a specific direction. This invention solves the problems listed above with a touch operation type electronic part with a push switch that is comprised of a touch position input unit that generates electrical signals or voltage that correspond to the touch position detector touched with a fingertip on the touch position detector arranged along a specific line, plane curve or arc; and a means to press the push switch using compression

or expansion of a flexible part different that the touch position input unit. This invention solves the problems listed above with a touch operation type electronic part with a push switch where the means to press the push switch is a single mechanism, that is arranged apart from the position where the touch position input unit is located or adjacent to the touch position input unit. This invention solves the problems listed above with a touch operation type electronic part with a push switch where there are irregularities on the fingertip contact surface of the touch position detection means. This invention solves the problems listed above with a touch operation type electronic part with a push switch comprised of a means to detect a single touch with touch detection sensors installed on the tops of keys. This invention solves the problems listed above with a touch operation type electronic part with a push switch comprised of a means to detect several contacts with multiple touch detection sensors installed on the tops of keys.
This invention solves the problems listed above with a touch operation type electronic part with a push switch with a touch panel installed on the tops of keys. This invention solves the problems listed above with a touch operation type electronic part with a push switch comprised of a means to detect contact with a touch panel installed on the tops of keys. This invention solves the problems listed above with a touch operation type electronic part with a push switch where there is a contact detector on the tops of keys installed on the switching means that is apart from the sensor contact point when pushed. This invention solves the problems listed above with a touch operation type input device where the switching means is conducted by a momentary method, an alternating method or a locking method.
[0013] The touch operation type input device in this invention can input analog displacement information via the fingertips using a touch mechanism and operation mechanism that is the best for human touch and that can detect the position, displacement value and pressure of a contact point that moves and shifts along a specific 1-dimensional, 2-dimensional or 3-dimensional trajectory. This operation part performs many function selections such as the subtle input for the volume switch and when used as a touch detection switch to input the number of sensor touch events, they can be freely modified using the touch of a finger so it is possible to improve the operability and multi-functionality by altering the number of events corresponding to the location touched by the finger. Also, maintenance can be improved by simplifying the structure of the operation part by having an electronic mechanism that performs these operations. It is also possible to simultaneously operate the touch operation type electronic part and the push switch functions with a

single part. Instead of the existing rotating operation type unit with a push switch, it is possible to form the device so the direction the switch is pressed is thinner so the switch can be placed in the center of the device. As a result, the device can be held in one hand so operations can easily take place using either hand. Finally, with a push key that has touch detection sensors as described above, it is possible to input events via touch other than pressing keys or with less pressure.

[0014]

[Embodiment Examples] Next, the examples for this invention are explained in detail by referencing the accompanying figures. This is a touch operation type input device comprised of a touch position detection means with touch position detection sensors arranged continuously along a specific line, plane curve or arc; with a switching means using a momentary method, an alternating method or a locking method that turns the point of contact on and off by movement along a trajectory different to the direction of the finger movement or by applying pressure using the touch position detection sensor as well as integrated detection of the position information from the point of contact along a trajectory according to the touch position detection means and the on/off information from the point of contact according to the switching means. The touch position detection means and the circuitry is explained in detail as follows. The specific structure for the signals or voltage output via the touch panels corresponding to the contact position using touch or pressure on an XY plane is explained in detail below.

[0015] The structure using an electrostatic induction detection means (electrostatic capacity) as the touch position detection means of the touch detection sensor involves a detection method that has multiple capacitors C1, C2, C3....through non-conductive glass for detecting contact via fingers where the capacity of these capacitors C1, C2, C3....changes according to the touch or proximity. These capacitors C1, C2, C3....are connected. As shown in Figure 1, there is a pulse generation circuit 1 that transmits frequency signals generated by the CR phase transmission circuit 3 by the voltage through the scanning drive circuit 2 that houses a decoder and counter to the frequency comparison circuit 4. These signals are compared with standard signals transmitted to the frequency comparison circuit 4 via the control circuit 5 from the pulse generation circuit 1. The signals from the frequency comparison circuit 4 and the standard signals from the control circuit 5 are simultaneously transmitted to the decision circuit 6. Based on the decision for both signals, the capacitor capacity is detected by the changes in touch at the point of finger contact.

[0016] Next is a description of the structure using a moveable electrode style detection means (moveable electrode switch type) as the touch position detection means of the touch detection sensor.

As shown in Figure 2(a), either the electrode with a linear arrangement along a trajectory or the electrode arranged intermittently with gaps filled with spacers 13 is designated as the moveable electrode 14 while the other is designated the stationery electrode 15. Using the finger, pressure is applied to the moveable electrode 14 to contact the stationary electrode 15 side. The position and time of the point of contact is used to detect the finger contact point. In Figure 2(b), the counter 11 is activated by the control circuit 10 to sequentially detect the points of contact S1, S2, S3 from the decoder 12. At this point, the part of the contact point that is on has LOW voltage to detect the point of contact.

[0017] Next is a description of the structure using an optical detection means (infrared detection type) as the touch position detection means. This is a method that performs finger touch detection as shown in Figure 3. There are multiple luminous elements 20 such as LED and multiple light receiving elements 21 such as phototransistors that are arranged 1:1 along both sides. These luminous elements 20 light up sequentially according to the demultiplexer 22 and the light is simultaneously received by the light receiving elements 21 via the multiplexer 23. The luminescence of the light received by these light receiving elements 21 is detected by the decision circuit 24. Based on the decision of the level of light, the finger touch position is detected. 25 refers to the control circuit that is connected to the demultiplexer 22, the multiplexer 23, and the decision circuit 24 that controls the circuit functions. The dotted line box in Figure 3 is the AD converter 26 that can be in between the multiplexer 23 and the decision circuit 24. Analog value detection can be conducted by the point of contact to improve the detection accuracy. Figure 4 shows another example of the optical detection means where the light receiving element 21 and the luminous element 20 are both installed on the bottom of the contact position. Figure 5 shows where the light receiving element 21 and the luminous element 20 are installed on both sides of the contact. As previously indicated, it is acceptable to install a push switch 47 between the light receiving element 21 and the luminous element 20.

[0018] Next is a description of the structure using a resistant film type detection means (resistant film electrode type) as the touch position detection means. As shown in Figure 6, a standard resistant film 30 is sandwiched between the electrode A and electrode B. This generates the potential distribution Q of the drive voltage and grounded voltage. As shown in Figure 7, the electrode 31 that is conductive to this resistant film 30 is installed in a parallel direction either under or on top of the resistant film 30. When touched with a finger, there is contact between the resistant film 30 and the electrode 31. This contact detects the position of the point of contact by measuring the changed voltage on the voltage measuring device 32. With any type of detection means as described above, the point of contact is output as position data with one-dimensional coordinates that correspond 1:1 to its trajectory. In particular, using the analog method, if close enough, it is possible to easily identify the direction of the fingertip movement and with the digital method, it is possible to identify if there are many points.

[0019] Next is a description of the structure used for the direct current resistance detection method for the touch position detection

means. For example, with an input operation resistance of 2MΩ and a BA653 touch sensor for the 7 circuits, as shown in Figure 11, a high level of resistance such as a finger contact extending between the metal contact point switches SW1~SW7 is detected. The high resistance detection terminal switch module SM converts the output level OUT1~OUT7 to 2 HIGH, LOW values that are used as the switches to detect when the metal is touched.

[0020] Alternatively, an electromagnetic induction method that utilizes a magnetic film instead of a resistant film or an ultrasonic detection method that uses ultrasonic oscillation instead of infrared LED can be employed.

[0021] As shown in Figure 8, this switching means is housed in a case P and has a contact point 42A on the substrate 49. There is a fan shaped button type push switch installed on a rubber elastic part 55 with a ring shape that shields the contact point 42A on the substrate 49. There is a contact point 42B installed facing the contact point 42A on the substrate under the push switch 47. There is a ring shaped touch position detector 40 on the end of the push switch 47. The touch position detector 40 and the cable socket for the touch position input unit 44 on the bottom of the substrate are connected by a cable K. When the push switch 47 is pressed, both the contact point 42A and 42B are touched to turn the switch on. It is possible to add a click button to the mouse on a PC.

[0022] It is possible to have an arrangement of luminophors 43 located below (refer to Figure 9) a touch position detector 40 on the touch position detection means or the surrounding area, or on something that allows light to penetrate the touch position detector 40 that flash according to the touch detection status that can be used for volume on a musical instrument such as an electronic piano that does not have a confirmation switch.

[0023] The switching means is as shown in Figure 10(a) and (b), when there is no fingertip contact with the touch position detector 40, only the contact point 42 is turned on and off. When the touch position detector 40 is pressed along with pressure on contact point 42, it can be connected with the touch position detector 40. Alternatively, as shown in Figure 10(c), (d) and (e), when there is no fingertip contact with the touch position detector 40, only the contact point 42 is turned on and off. When the touch position detector 40 is connected during pressure on contact point 42, it can be pressed down at the same time.

[0024] As shown in Figure 19, the switching means can involve a swinging cam structure where one tip of the triangular cam 70 can rotate inside a casing P and can swing along a horizontal surface. Other points on the triangular cam 70 can turn the contact point on and off by applying pressure to the touch position detector 40.

[0025] As shown in Figure 12, when using the touch operation type electronic part with a push switch in this invention, there is a push

switch that is comprised of a touch position input unit 44 that generates electrical signals or voltage that corresponds to the touch position detector 40 touched with a fingertip on the touch position detector 40 arranged along a specific line, plane curve or arc;

a substrate with contact points 45 containing a means to transmit electrical signals or voltage between touch position input 44 contact points that have a touch position input unit 44 that can move horizontally within a given range; a coil shaped spring 46 that horizontally presses against the touch position input unit 44; and a push switch 47 on the substrate with contact points 45 with a slide that acts to press the touch position input unit 44 against the force of the spring 46.

[0026] As shown in Figure 13(b) and (c), when using the touch operation type electronic part with a push switch in this invention, there is a push switch that is comprised of a touch position input unit 44 that generates electrical signals or voltage that corresponds to the touch position detector 40 touched with a fingertip on the touch position detector 40 arranged along a specific line, plane curve or arc; a substrate 49 that has a push switch 47 on the top that is operated via a tongue-shaped contact point 51 connected to a fixed contact point 48 for the touch position input unit 44; a support 50 on the substrate 49 that supports the touch position input unit 44 that has a contact point on the bottom that corresponds to the fixed contact point 48 and that supports the hinge shaped swinging part 52 such that it can swing around the support 50 on a centrally located spring 46; a protruding operating part 53 on one edge of the swinging part 52 that drives the push switch 47 to start swinging by pressing down against the elastic part of the spring 46 on the swinging part 52; and a push switch 47 that can be pressed when sufficient pressure is applied to the parts of the touch position detector 40. Also, as shown in Figure 13(a), the operating part 53 of the protrusions on the left and right edges of the swinging part 52 are formed in a seesaw shape so if there are push switches 47A, 47B on the substrate corresponding to the operating part 53, it is possible to input two types with two push buttons.

[0027] As shown in Figure 14(a) and Figure 22(a) and (b), when using the touch operation type electronic part with a push switch in this invention, there is a push switch that is comprised of a touch position input unit 44 that generates electrical signals or voltage that correspond to the touch position detector 40 touched with a fingertip on the touch position detector 40 arranged along a specific line, plane curve or arc; a substrate 49 for the touch position input unit 44 with fixed contact points 48 and a push switch 47 on the top that is operated from the top; a support 60 on both sides or the lower center of the touch position detector 40 can go up and down into an axle opening for a guide 61 on the substrate 49; an elastic part such as a coil spring 46 between the touch position input unit 40 and the substrate 49 that provides flexible resistance towards the

stop 49A on the top of the substrate 49; and a push switch that can be pressed when sufficient pressure is applied to the parts of the touch position detector 40 against the resistance of the spring 46 elastic part. Also in Figure 14(b) there is a push button on the touch position detector 40, and the support 60 under the touch position detector 40 can be inserted into the axle opening for a guide 61 installed on the substrate 49, and the coil spring 46 is between the touch position input unit 44 and the substrate 49. As shown in Figure 15(c)-(d), when there are three push switches 47, it is appropriate for character input such as with PC or word processors. There is a pair of plate springs 62 on both sides of the touch position input unit 44 and by applying pressure from below to the touch position detector 40, pressure is then applied to one of the other two push switches 47B, 47C opposite the plate spring 62 horizontally along the touch position detector 40. As shown in Figure 15(a)-(b), when there are 2 push switches 47, the bottom of the touch position input unit 44 freely swings to the right and left so pressure is then applied to one of the two push switches 47B, 47C on the touch position input unit 44.

[0028] It is acceptable to have a touch position input unit 44 that generates electrical signals or voltage that corresponds to the touch position detector 40 touched with a fingertip on the touch position detector 40 arranged along a specific line, plane curve or arc; touch position input units 44 that are inserted into guide connectors 54 containing cavities, openings or penetration holes on the touch position input unit 44 to connect the support unit; and a push switch 47 that can be pressed when sufficient pressure is applied to the spring 46 that horizontally presses against the touch position input unit 44.

[0029] As shown in Figure 16(a)-(d), there is a touch position input unit 44 that generates electrical signals or voltage that corresponds to the touch position detector 40 touched with a fingertip on the touch position detector 40 arranged along a specific line, plane curve or arc; and a part such as a one-way push mechanism 90 that turns the contact point 42 on and off by pressing the touch position input unit 44 in a specific direction. Also, by pressing the touch position input unit 44 via expansion or contraction of a rubber shaped elastic part, the push switch 47 can be pressed down. Also, as shown in Figure 14(c), there are protrusions 41 on one or both sides of the touch position detector 40 on the touch position detection means that act as the switching means, and when pressed, these protrusions 41 turn the contact point on the push switch 47 on and off. This can be applied to the click button used on a mouse on a PC and can be adapted to a word processor keyboard. As indicated above, the touch operation type electronic part with a push switch

can be adapted for use as a PC or word processor keyboard, and the keyboard can be used as a sensor to detect contact. Alternatively, a cellular telephone keypad can be the contact sensor, so there are fewer keys. Instead of the existing rotating operation type unit with a push switch, it is possible to form the device so the direction the switch is pressed is thinner so the switch can be placed in the center of the device. As a result, the device can be held in one hand so operations can easily take place using either hand. Finally, there are irregularities for easy recognition so it is possible to input events by touching the touch position detector 40 with a fingertip.
[0030] The touch position detection sensors are arranged along a multiple touch detection trajectory that is either the same or different from the displacement unit and are either uniformly distributed in a wide band or non-uniformly distributed with varying densities. Specifically, the density of the distribution of the touch position detection sensors is either at the center or the ends, and it is possible for the density to change gradually from one end to the other. Therefore it is possible to freely adjust the touch of a finger to the location and the number of events can be altered. There can be touch position detection sensors that detect the contact position with at least one, two or three or more adjacent sensors.
[0031] As shown in Figure 18(a), the means to press the push switch can be a single mechanism such as a cellular telephone. The position and remote position on the opposite side for the touch position input unit 44 is on the push switch 47. As shown in Figure 18(b)-(d) and Figure 17, it can be near or in the vicinity of the touch position input unit. Figure 17(a) shows the arrangement of the band type push switch 47 on the side of a cellular telephone parallel to the band type touch position input unit 44. Figure 17(b) shows the arrangement of the round push switch 47 on the side of a cellular telephone adjacent to the arc shaped touch position input unit 44. Figure 18(b) shows the round push switch 47 underneath the vertical band type touch position input unit 44 in the center of a cellular telephone. Figure 18(c) shows the push switch 47 adjacent to the vertical band type touch position input unit 44 in the center of a cellular telephone. Figure 18(d) shows the round push switch 47 underneath the horizontal band type touch position input unit 44 in the center of a cellular telephone. Also, Figure 18(e) and (f) show the push switch 47 in the center of a round or rectangular touch position input unit 44. Figure 18(g) shows a push switch 47 on the outside of a round touch position input unit 44.
[0032] If another input is performed by touch pressure with fewer input keys to turn the contact points on/off, when there is analog input on the input device to turn the contact points on/off, as shown in Figures 20-21, there are small rounded touch detection sensors 81

on the top of the keys. There is something that holds a means to detect a single contact (refer to Figure 20(a)), or multiple rectangular touch detection sensors 81A, 81B..., or rectangular touch panels 82 on the entire surface of the top of the key 80 that can support a means to detect contact (refer to Figure 20(c), (d)). On the top of the keys 80 is a ring shaped contact detector 83 for fingertip operation and sensor contact points 84 that connect when the top of the key 80 is pushed (refer to Figure 20(a) and (b)) or that can be separated.

[0033]

[Effect of this Invention] With the structure indicated above, this invention is a touch operation type input device with a push switch that can precisely input analog type displacement information or contact point movement information to an electronic mechanism and that can detect the position, displacement value and pressure of a contact point that moves and shifts along a 1-dimensional, 2-dimensional or 3-dimensional trajectory. It is also possible to provide a touch operation type electronic part with a push switch that can perform multiple operations with one unit so there can be an electronic mechanism structure that has good operability and is lightweight because of fewer parts.

[0034] The touch operation type input device in this invention can input analog displacement information via the fingertips using a touch mechanism and operation mechanism that is the best for human touch and that can detect the position, displacement value and pressure of a contact point that moves and shifts along a specific 1-dimensional, 2-dimensional or 3-dimensional trajectory. This operation part performs many function selections such as the subtle input for the volume switch and when used as a touch detection switch to input the number of sensor touch events, they can be freely modified using the touch of a finger so it is possible to improve the operability and multi-functionality by altering the number of events corresponding to the location touched by the finger. Also, maintenance can be improved by simplifying the structure of the operation unit by having an electronic mechanism that performs these operations. It is also possible to simultaneously operate the touch operation type electronic unit and the push switch functions with a single part. Instead of the existing rotating operation type unit with a push switch, it is possible to form the device so the direction the switch is pressed is thinner so the switch can be placed in the center of the device. As a result, the device can be held in one hand so operations can easily take place using either hand. Finally, with a push key that has touch detection sensors as described above, it is possible to input events via touch other than pressing keys or with less pressure.

[Brief Description of the Figures]
[Figure 1] This is a circuit diagram showing the electrostatic induction detection means for the embodiment example in this invention.
[Figure 2] This shows the moveable electrode detection means for the embodiment example in this invention;(a) is the circuit diagram and (b) is the cross-section.
[Figure 3] This is a circuit diagram showing the optical detection means for the embodiment example in this invention.
[Figure 4] This shows the luminous element and the light receiving element on the optical detection means for the embodiment example in this invention;(a) is the cross-section diagram and (b) is the overhead view.
[Figure 5] This shows another diagram of the luminous element and the light receiving element on the optical detection means for the embodiment example in this invention.
[Figure 6] This is a summary diagram showing the resistant film detection means for the embodiment example in this invention; (a) shows the arrangement of the resistant film and (b) is a diagram explaining the voltage distribution.
[Figure 7] This is a circuit diagram showing the same resistant film detection means.
[Figure 8] This shows the switching means for the embodiment example in this invention;(a) is the cross-section diagram and (b) is the overhead view.
[Figure 9] This shows the touch position detector for the embodiment example in this invention.
[Figure 10] This shows another switching means for the embodiment example in this invention; and is a summary diagram explaining the pressed state only for switching and the pressed state for the touch position detector center part.
[Figure 11] This is a circuit diagram showing the direct current resistance detection method for the embodiment example in this invention.
[Figure 12] This shows the horizontal slide type push switch attached to the touch operation type electronic part for the embodiment example in this invention.
[Figure 13] This is a diagram showing another application example for the same push switch attached to the touch operation type electronic part; (a) is the seesaw type, (b) is the hinge type, and (c) is a front view of (b).
[Figure 14] This is a cross-section diagram showing another application example for the same push switch attached to the touch operation type electronic part; (a) is the flat type electronic part, (b) and (c) are button type electronic parts.

[Figure 15] This is another application example for the same push switch attached to the touch operation type electronic part.
[Figure 16] This is a cross-section view showing another application example for the same push switch attached to the touch operation type electronic part.
[Figure 17] This is another application example for the same push switch attached to the touch operation type electronic part; (a) is the band type and (b) is the round type.
[Figure 18] This is a summary diagram of another application example for the same push switch attached to the touch operation type electronic part.
[Figure 19] This is a summary diagram of another application example for the same push switch attached to the touch operation type electronic part.
[Figure 20] This is a summary diagram of another application example for the same push switch attached to the touch operation type electronic part.
[Figure 21] This is a summary diagram of another application example for the same push switch attached to the touch operation type electronic part.
[Figure 22] This is a summary diagram of another application example for the same push switch attached to the touch operation type electronic part.

[Description of Symbols]
1...pulse generation circuit
2...scan drive circuit
3...CR phase shifting oscillating circuit
4...frequency comparison circuit
5, 10, 25...control circuit
6, 24...decision circuit
11...counter
12...decoder
20...luminous element
21...light receiving element
22...demultiplexer
23...multiplexer
26...AD converter
30...resistant film
31...electrode
40...touch position detector
41...protrusion
42, 51...contact point
43...luminophor
44...touch position input unit
45...substrate with contact point
46...spring

47...push switch
49...substrate mounting
52...swinging part
53...operating part
55...elastic part

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[Figure 1]
[Figure 2]
[Figure 4]
[Figure 7]
[Figure 9]

[page break (13) 11-194872]

[Figure 3]
[Figure 5]
[Figure 6]
[Figure 8]

[page break (14) 11-194872]

[Figure 10]
[Figure 12]
[Figure 11]
High resistance detection electronic switching module
Metal contact switch

[page break (15) 11-194872]

[Figure 13]
[Figure 14]
[Figure 17]
[Figure 19]

[page break (16) 11-194872]

[Figure 15]
[Figure 18]
[Figure 21]

[page break (17) 11-194872]

[Figure 16]
[Figure 22]

[page break (18) 11-194872]

[Figure 20]

[page break (19) 11-194872]

[page break (20) 11-194872]

[page break (21) 11-194872]

[page break (22) 11-194872]